Working with LTER Network– CAP& BES

Chris Costello
Matt Kotchen
Steve Polasky
**Kerry Smith**

Outline

- **Description of one project –ecosystem services – Costello, Kotchen, Smith**

- **NSF Science based funding in environment usually has lead role for natural sciences—example**

- **Propose link to LTERs –CAP and BES**

- **What are they?**

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NSF SEES Program –Deadline November 15, 2011

- **The CNH Program is one of a portfolio of existing and new programs and competitions that are part of an NSF-wide investmenteffort focusing on** Science, Engineering, and Education for Sustainability (SEES**). SEES aims to generate the discoveries andcapabilities in climate and energy science and engineering needed to inform societal actions that lead to environmental andeconomic sustainability. CNH proposals consistent with SEES objectives are encouraged to articulate the connections to SEES. (Formore information about SEES, go to http://www.nsf.gov/geo/sees/.)**

- **The CNH Program aims to support basic research and related activities that enhance fundamental understanding of the complexinteractions within and among natural and human systems, with special emphasis placed on the coupling between human andnatural systems. Through its annual competitions, CNH intends to support three types of activities:**

- *A. CNH Large Interdisciplinary Research Projects.* **Large interdisciplinary research projects may be supported by awards acrossa range of sizes from roughly $500,000 to no more than $1,500,000. Budgets should be developed at scales appropriate for theproject to be conducted. Most projects will extend from two to five years in duration.**

- *B. CNH Interdisciplinary Team Exploratory Projects.* **Support for exploratory efforts by emerging multidisciplinary teams isdesigned to facilitate the kinds of contact, interaction, and active research activities necessary to enable researchers from multiplefields to engage in effective interdisciplinary research. Emphasis is to be placed on the conduct of research and potential outcomes,not on the preparation of plans and proposals for future research. Exploratory projects may be supported in a range from roughly$150,000 to no more than $250,000. Most exploratory projects will extend from one to two years in duration.**

- *C. CNH Research Coordination Networks (CNH-RCNs).* **Research coordination networks focusing on the dynamics of couplednatural and human systems will aim to advance CNH research or create new directions in research or education, with innovativeideas for implementing novel networking strategies especially encouraged. CNH-RCNs may be supported in a range from roughly$250,000 to no more than $500,000. CNH-RCNs will extend five years in duration**

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II. PROGRAM DESCRIPTION

The Dynamics of Coupled Natural and Human Systems (CNH) Program supports basic research and related activities that enhance fundamental understanding of the complex interactions within and among natural and human systems. CNH focuses on the complex interactions among human and natural systems at diverse spatial, temporal, and organizational scales. CNH seeks to advance basic knowledge about the system **dynamics** -- the processes through which systems function and interact with other systems. CNH-supported projects must examine relevant **natural AND human systems**. Proposals cannot focus solely or largely on either human systems or on natural systems. Projects also must examine the full range of **coupled** interactions and feedbacks among relevant systems. The arrows in the accompanying figure symbolize these relationships.
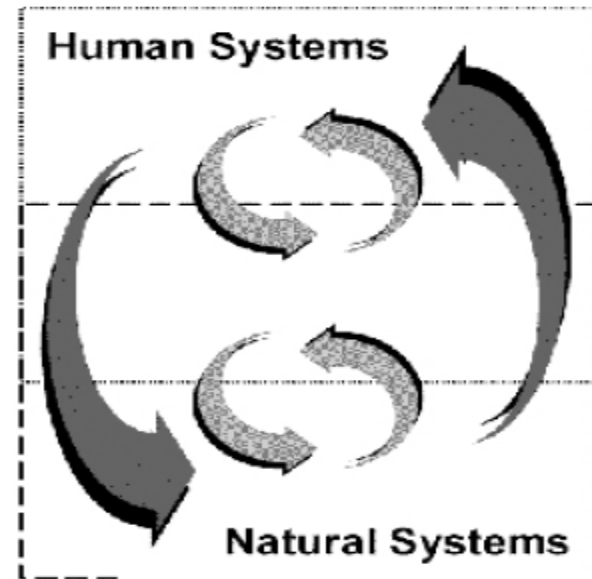
Estimated Number of Awards: 15 to 18

Anticipated Funding Amount: $17,000,000 This total is for awards to be made annually, pending availability of funds.

Almost all CNH funding is expected to be available for awards to be made based on evaluation of proposals submitted for this competition. NSF intends to make awards across a range of sizes as specified for the following types of awards.

A. Large CNH Interdisciplinary Research Projects. Large interdisciplinary research projects may be supported by awards across a range of sizes from roughly $500,000 to no more than $1,500,000. Most projects will extend from two to five years in duration.

B. CNH Interdisciplinary Team Exploratory Projects. Exploratory efforts may be supported in a range from roughly $150,000 to no more than $250,000. Most exploratory projects will extend from one to two years in duration.

C. CNH Research Coordination Networks. CNH-RCNs may be supported in a range from roughly $250,000 to no more than $500,000. CNH-RCNs will extend five years in duration.

Budgets should be developed at scales appropriate for the project to be conducted. No award may be more than five years in duration.

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In FY 2011, NSF plans to encourage interdisciplinary research and education on energy sustainability, with a particular emphasis on the socioeconomic and environmental implications. Potential areas of emphases include the development of sustainable energy technologies, development of techniques for effective and efficient use of water resources, and research in transportation technology. A continued focus will be placed on creating the necessary workforce to address sustainability challenges and connecting elements of the SEES portfolio. Specific efforts will support postdoctoral researchers and early career scientists at the interfaces between social sciences and other science and engineering disciplines.

The SEES Portfolio will support research and education projects that span all eleven NSF Directorates and Offices, including:

- research at the energy-environment-society nexus
- novel energy production, harvesting, storage, transmission, and distribution technologies, and their intelligent control that minimizes environmental impact and corresponding adoption, socioeconomic, and policy issues
- innovative computational science and engineering methods and systems for monitoring, understanding and optimizing life-cycle energy costs and carbon footprints of natural, social and built systems (including IT systems themselves)
- data analysis, modeling, simulation, visualization, and intelligent decision-making facilitated by advanced computation to understand impacts of climate change and to analyze mitigation strategies
- study of societal factors such as vulnerability and resilience, and sensitivity to regional change
- short and long term research enabled by a new generation of experimental and observational networks
- support for interdisciplinary education/learning science research, development, and professional capacity-building related to sustainability science and engineering
- creation of research and education partnerships around forefront developments in sustainability science and engineering, both nationally and internationally
- development of the workforce required to understand the complexities of environmental, energy, and societal sustainability
- engaging the public to understand issues in sustainability and energy
- development of the cyberinfrastructure and research instrumentation needed to enable sustainability science and engineering
- support of the physical, cyber, and human infrastructure necessary to achieve SEES goals

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CAP LTER -- Site Location

- **Metropolitan Phoenix and surrounding desert**

- **Possible future expansion to examine dynamics in Sun Corridor Megapolitan Area**
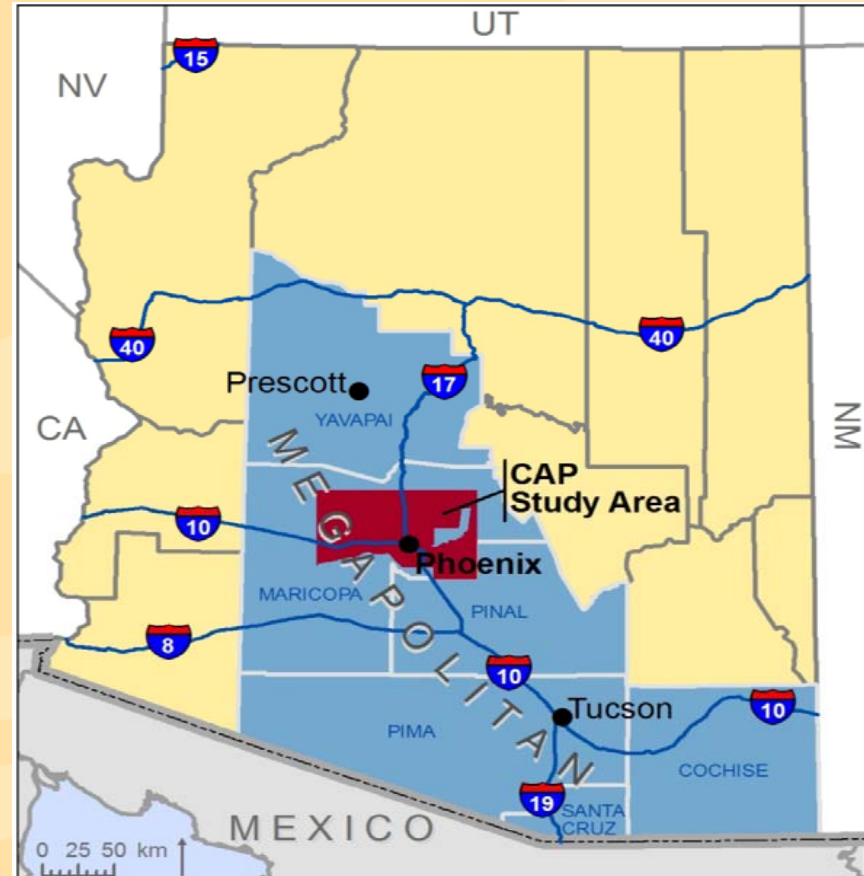
Central Research Question

- **CAP3: 2010-2016**
  - Central research question: *How do the services provided by evolving urban ecosystems affect human outcomes and behavior, and how does human action (response) alter patterns of ecosystem structure and function and, ultimately urban sustainability, in a dynamic environment?*
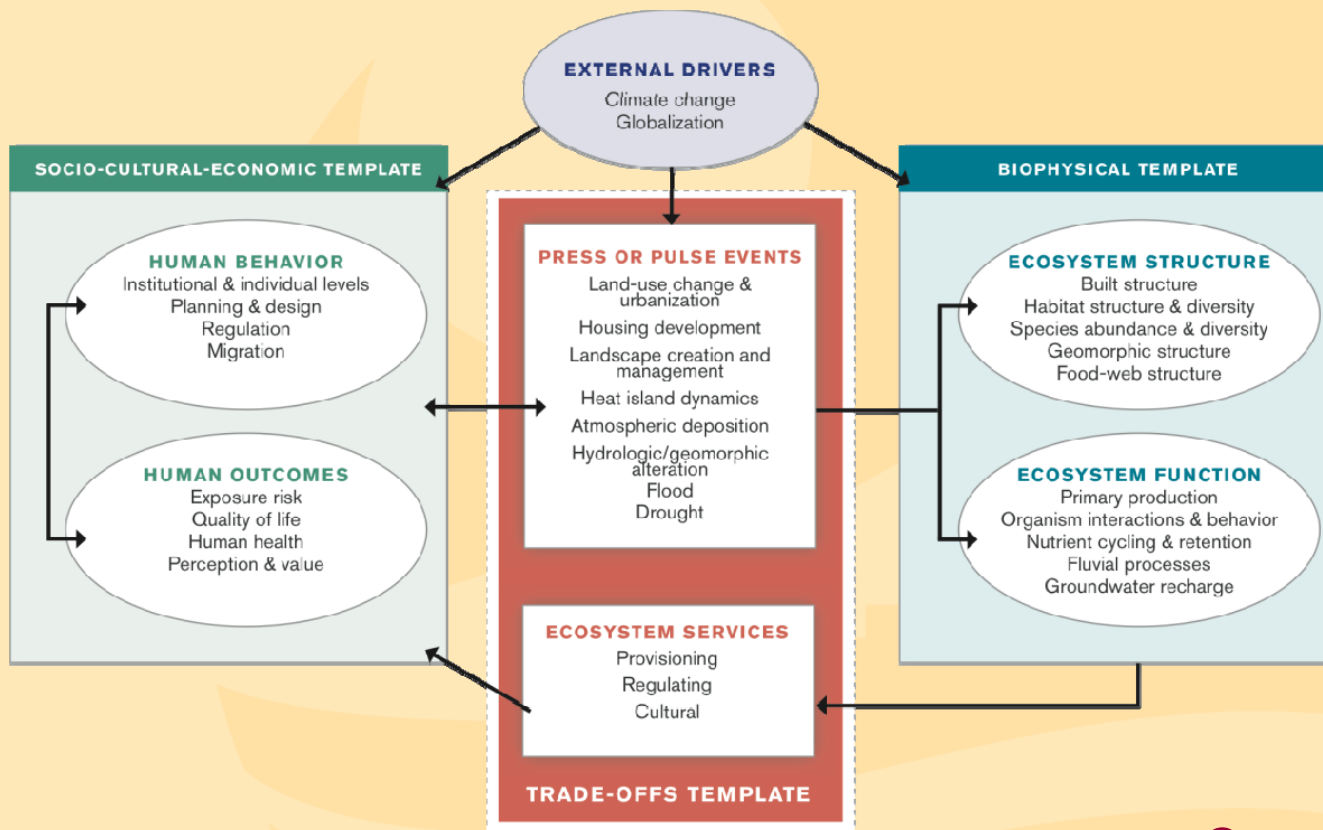
Conceptual Framework

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CAP3 IPAs

- **Climate, ecosystems and people**
  Ben Ruddell and Sharon Harlan
- **Water dynamics in a desert city**
  Dan Childers & Ray Quay
- **Biogeochemical patterns, processes, and human outcomes**
  Chris Boone & Sharon Hall
- **Human decisions and biodiversity**
  John Sabo & Paige Warren

CAP 3 Cross-cutting and Foundational Research

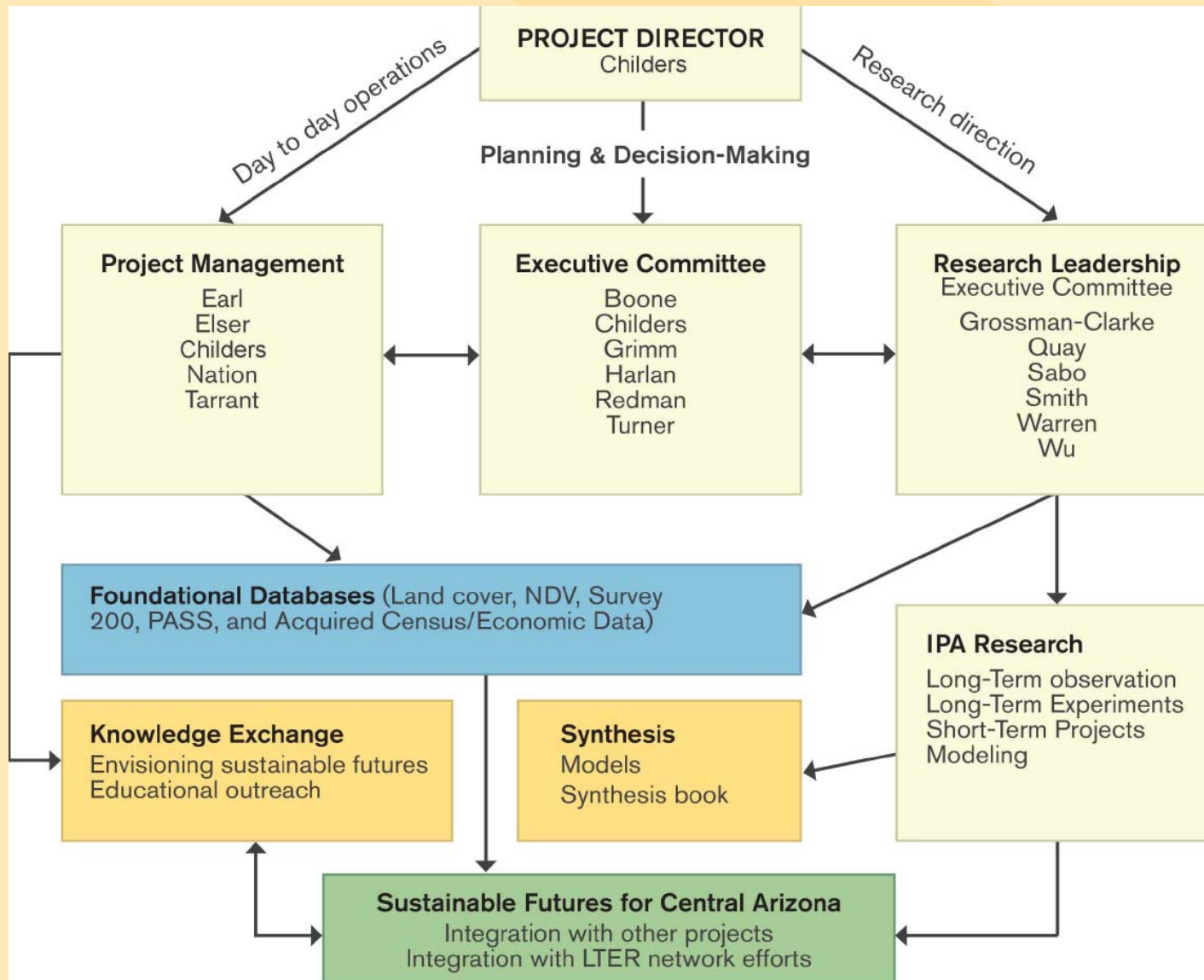- **Characterizing land use, land cover, and land architecture**
  Jianguo Wu & Billie Turner

- **NDV experimental suburb**
  Chris Martin & David Casagrande

- **Survey 200**
  Stevan Earl

- **Phoenix Area Social Survey**
  Sharon Harlan

- **Economic and census data analysis**
  Kerry Smith & Chris Boone

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CAP3 Research Integration

Project Management

PROJECT DIRECTOR
Childers

Day to day operations

Planning & Decision-Making

Research direction

Project Management
Earl
Elser
Childers
Nation
Tarrant

Executive Committee
Boone
Childers
Grimm
Harlan
Redman
Turner

Research Leadership
Executive Committee

Grossman-Clarke
Quay
Sabo
Smith
Warren
Wu

Foundational Databases (Land cover, NDV, Survey 200, PASS, and Acquired Census/Economic Data)

IPA Research
Long-Term observation
Long-Term Experiments
Short-Term Projects
Modeling

Knowledge Exchange
Envisioning sustainable futures
Educational outreach

Synthesis
Models
Synthesis book

Sustainable Futures for Central Arizona
Integration with other projects
Integration with LTER network efforts

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Long-Term Ecological Research
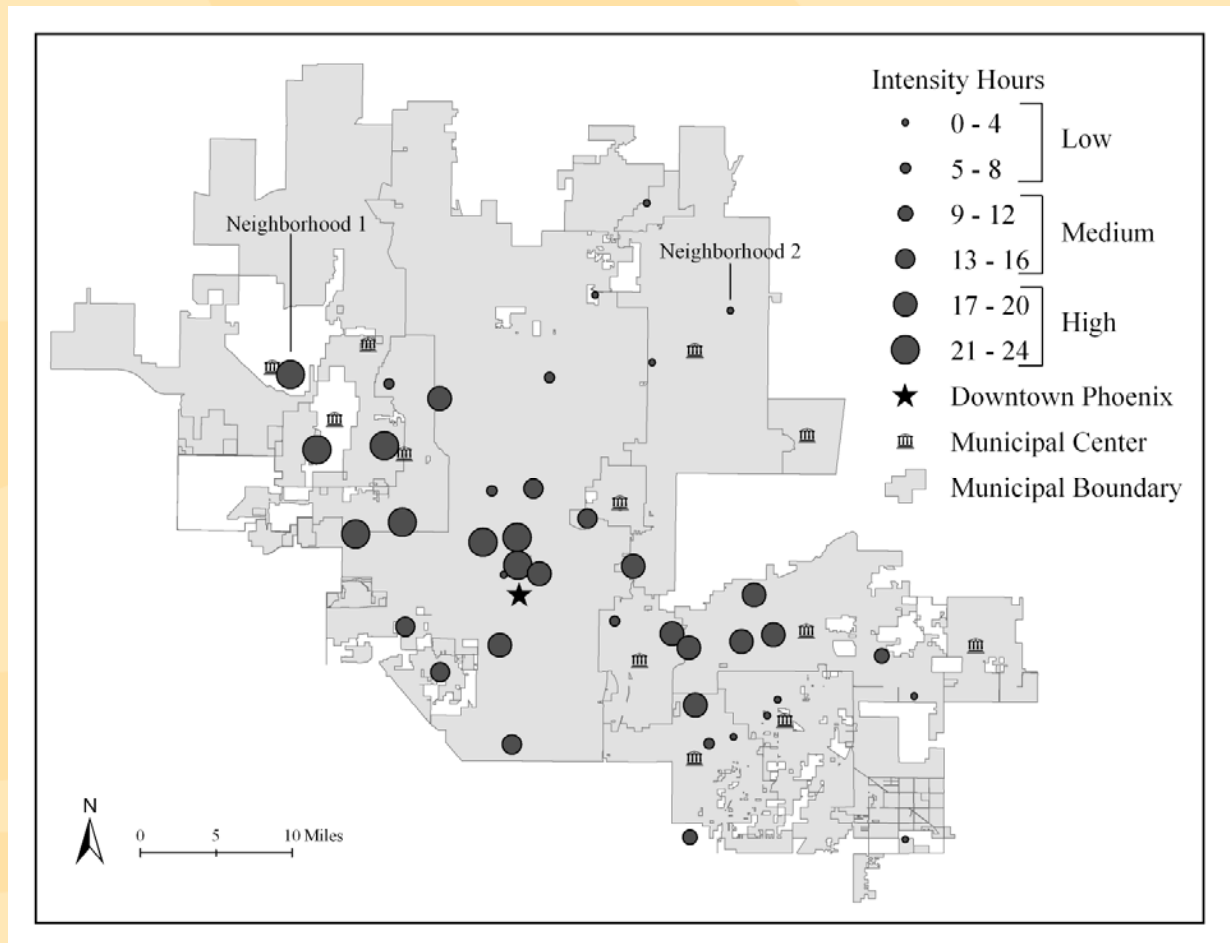
Hours of Exposure to Extreme Heat by Neighborhood
July 15-19, 2005

• Extreme temperatures variably distributed

• Residents at greatest risk of exposure are minority, low-income and elderly

• What are the relationships between temperature, ecosystem services, & health?

From Ruddell et al. 2010

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Indian Bend Wash: A Designed Ecosystem

- Floodway supports the natural flooding regime with minor economic consequences

- Lakes are hotspots for N cycling

- This is a new, designed aquatic ecosystem: what services does it provide, and what trade-offs are made?

From Roach et al. 2008, BioScience

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CAP LTER Leveraged Funding 1998-2010
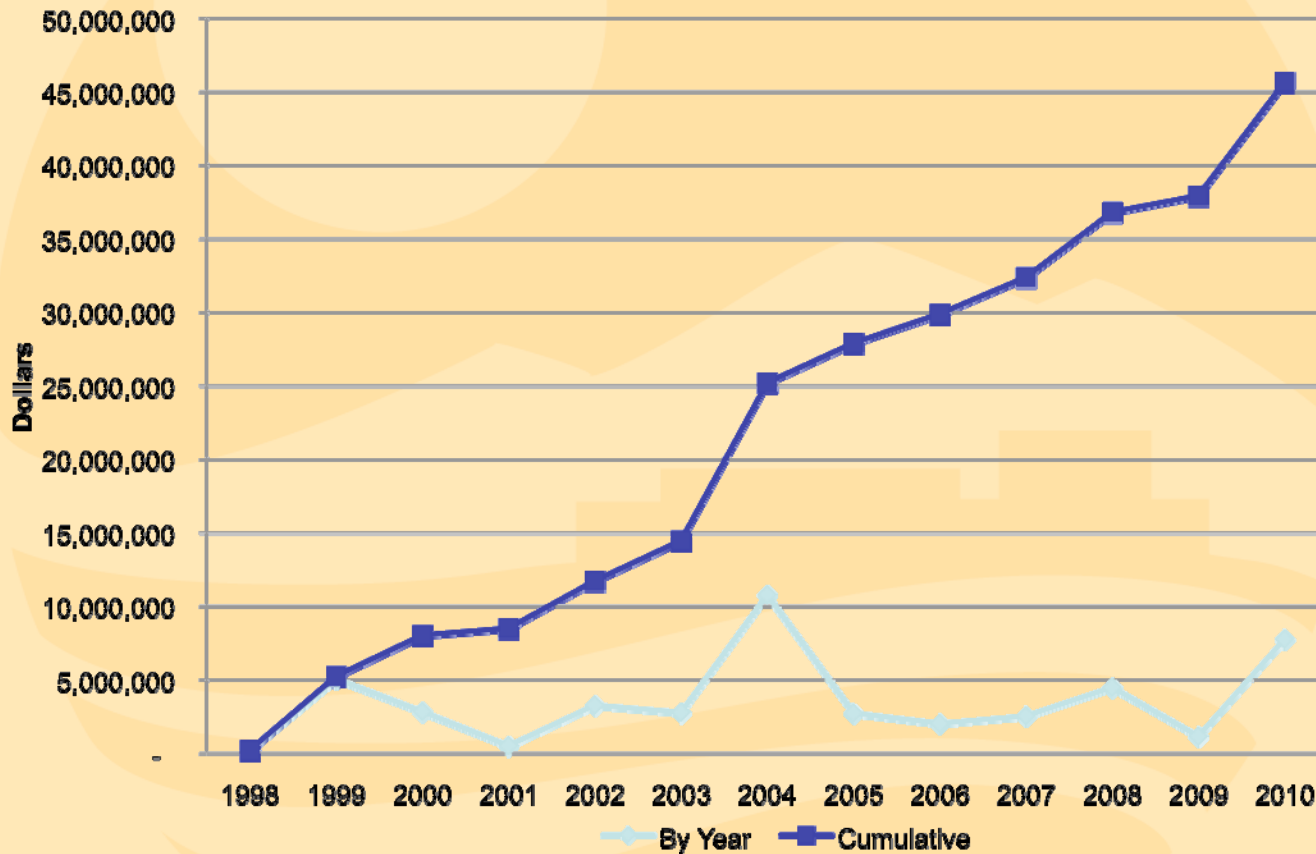
•**Over $45 million in funding leveraged from CAP LTER since 1998**

Baltimore LTER

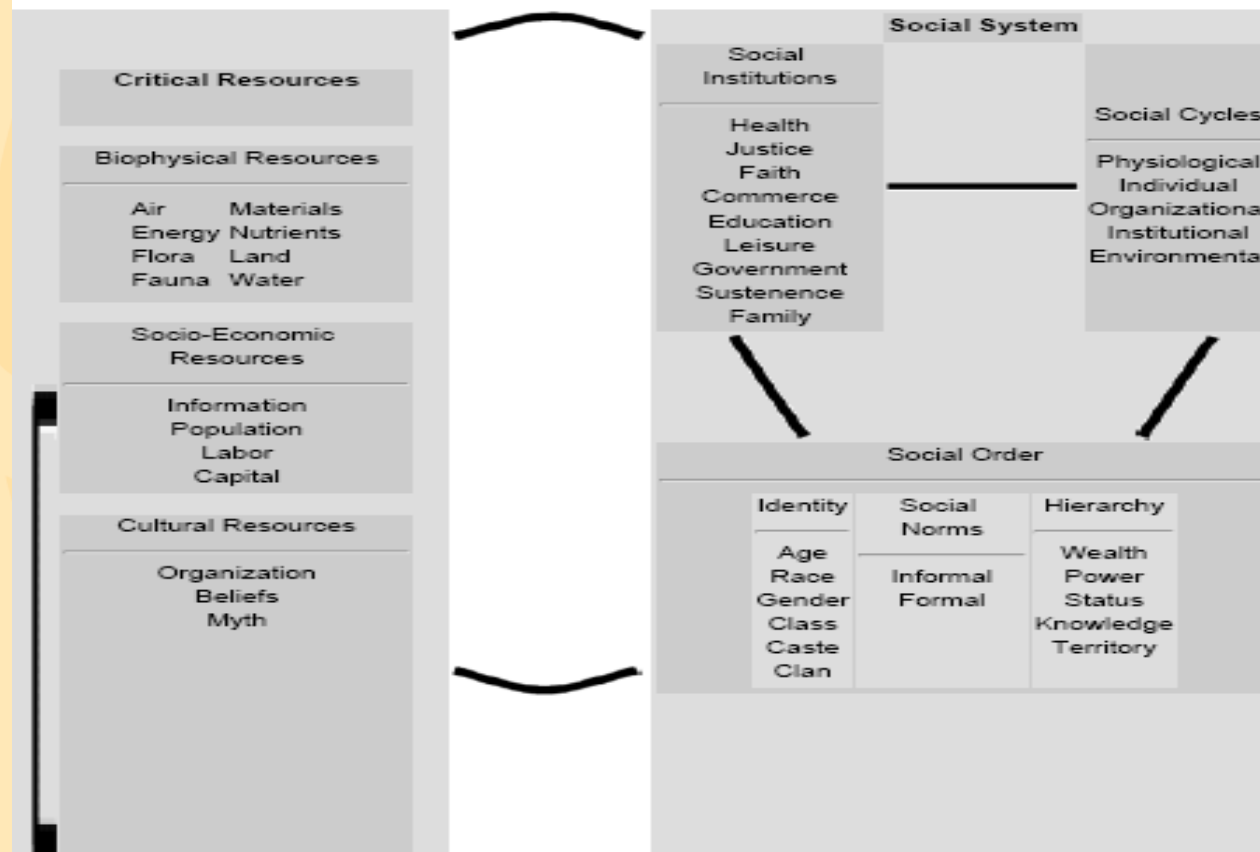## Baltimore Ecosystem Study Research Goals

The Baltimore Ecosystem Study Long-Term Ecological Research project seeks to understand a major urban region as an ecological system. The project focuses on a five county metropolitan region in which watersheds can be used as the stage on which to understand the reciprocal interactions of the social, biophysical, and built environments. Using watershed function as a synthetic indicator and target for model development, the project seeks to answer three questions:

1. **What are the fluxes of energy and matter in the Baltimore metropolitan ecosystem, and how do they change over the long term?**

2. **How does the spatial structure of ecological, physical, infrastructural, and socio-economic factors in the metropolis affect ecological processes?**

3. **How can urban residents develop and use an understanding of the metropolis as an ecological system to improve the quality of their environment and their daily lives?**

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The Human Ecosystem Framework

Human Ecological System as a data integrator and interface

Our information and data management approach is centered around an adaptation of the Human Ecosystem Framework (Machlis, Force, and Burch), called the Human Ecological System (HES). The HES (below) interface serves as a strucuture by which we will integrate, or "hang", Baltimore Ecosystem Study data in a meaningful way. Although users will be able to access BES data via traditional lists and search engines, our hope is that the HES will stand as our primary mechanism of data transfer thereby solidifying the notion that urban ecology requires a systems approach and when integrated, these data will yield a more meaningful and accurate characterization of the Gywnns Falls Watershed and the ecology of the Baltimore Metropolitan Region.

Critical Resources

Biophysical Resources

Air	Materials
Energy	Nutrients
Flora	Land
Fauna	Water

Socio-Economic Resources

Information
Population
Labor
Capital

Cultural Resources

Organization
Beliefs
Myth

Social System

Social Institutions

Health
Justice
Faith
Commerce
Education
Leisure
Government
Sustenence
Family

Social Cycles

Physiological
Individual
Organizational
Institutional
Environmental

Social Order

Identity	Social Norms	Hierarchy
Age		Wealth
Race	Informal	Power
Gender	Formal	Status
Class		Knowledge
Caste		Territory
Clan		

Adapted from Machlis, Force, and Burch, 1994

Economists in LTER's

- **CAP – Kerry, Josh Abbott, Eli Fenichel, Michael Hanemann, Nick Kuminoff, Charles Perrings**

- **BES – Elena Irwin (Ohio State), and presumably facultyin Department of Agricultural, Environmental and Development Economics at OSU (Tim Haab, Allen Klaiber, Brent Sohngen, Brian Roe)**

Cross-Site Research
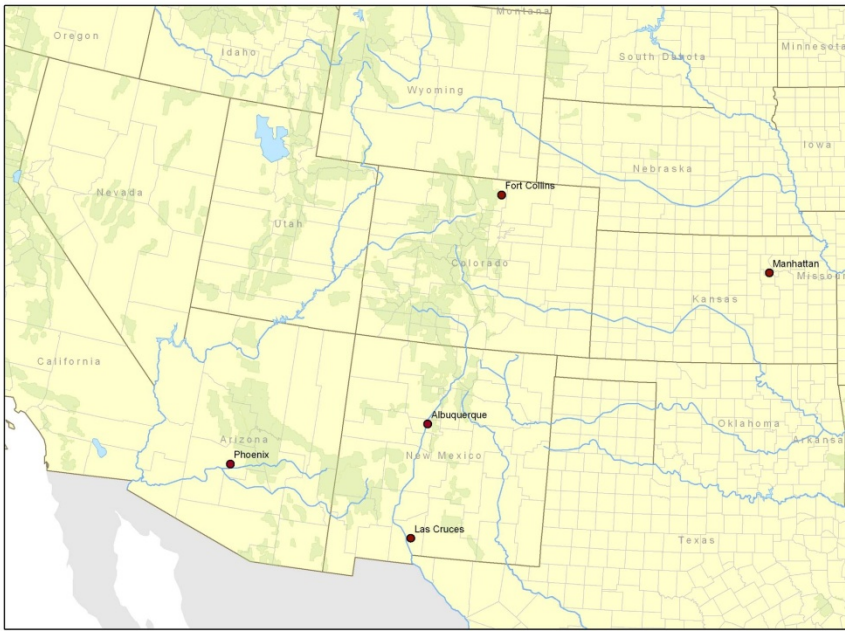
- **Land fragmentation and urbanization** (CAP, JRN, SEV, SGS, & KNZ)

- **Comparative environmental justice** (CAP & BES)

- **Comparative urban climate** (CAP & BES)

- **Residential landscapes** (CAP, BES, PIE, & FCE)
- **Maps and Locals** (19 LTER sites & 3 int'l sites)
- **ULTRA-Ex** (CAP, SEV, & JRN)
- **Scenarios of land change** (Network-wide)
- **Comparative avian community ecology** (CAP & BES)

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Next Steps

- **Identify who might be interested and decide if we want to establish links with LTERs**

- **Seek NBER "blessing" and mechanism to coordinate**

- **Plans to meet deadline for proposal**

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